

XXVI Congresso AIOL, S. Michele all'Adige
27 giugno – 1 luglio 2022

PLENARY LECTURES

MICHAEL LOMAS

Affiliation

Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, 04544, USA



Plenary lecture

Biology trumps ocean warming: adaptive biogeochemistry in the sargasso sea

Ocean ecosystem models predict that warming and increased surface ocean stratification will trigger a series of ecosystem events, ultimately reducing the biological export of particulate carbon to the ocean interior. We present a nearly three-decade time series from the open ocean that documents a biological response to ocean warming and nutrient reductions wherein particulate carbon export is maintained, counter to expectations. Carbon export is maintained through a combination of phytoplankton community changes to favor cyanobacteria that have higher nutrient use efficiencies manifested in high cellular carbon-to-phosphorus ratios and enhanced shallow phosphorus recycling leading to increased nutrient use efficiency by the ecosystem. The role of cross trophic level interactions in further supporting carbon export

remain to be resolved. These results suggest that surface ocean ecosystems may be more responsive and adapt more rapidly to changes in the hydrographic system than is currently envisioned in earth ecosystem models, with positive consequences for ocean carbon uptake.

Biosketch

I am a marine biogeochemist with a broad interest in the role that phytoplankton diversity and physiology plays in mediating the key processes of the biological carbon pump, and associated macronutrient cycles. While all phytoplankton fix inorganic carbon, they are plants after all, different phytoplankton assemblages lead to different foodweb structures and ultimately different efficiencies of the biological carbon pump, as well as the flow of carbon and energy to higher trophic levels. Lomas' lab uses a combination of natural field observations, and field and laboratory manipulation experiments to study innate differences in phytoplankton physiology in the field and how different phytoplankton groups respond to climate change, in particular ocean acidification.

Email

mlomas@bigelow.org

Web

<https://www.bigelow.org/about/people/mlomas.html>

Selected publications

- Lomas, M.W., Bates, N.R., Johnson, R.J., Steinberg, D.K., Tanioka, T. Adaptive Biogeochemistry Leads to Counter-intuitive Carbon Export Response to Warming in the Sargasso Sea. *Nature Communications*, 13: 1211. DOI: 10.1038/s41467-022-28842-3.
- Tanioka, T., Matsumoto, K., Lomas, M.W. 2021. Drawdown of atmospheric pCO₂ via dynamic particle export stoichiometry in the ocean twilight zone. *Geophysical Research Letters*, 48: e2021GL094924.
- Lomas, M.W., Baer, S.E., Mouginot, C., Terpis, K.X., Lomas, D.A., Altabet, M.A., Martiny, A.C.. 2021. Varying influence of phytoplankton biodiversity and stoichiometric plasticity on bulk particulate stoichiometry across ocean basins. *Communications: Earth and Environment*, 2:143. DOI:10.1038/s43247-021-00212-9.
- Martiny, A.C., Hagstrom, G.I., DeVries, T., Letscher, R.T., Britten, G.L., Garcia, C.A., Galbraith, E., Karl, D.M., Levin, S.L., Lomas, M.W., Moreno, A.R., Talmy, D., Wang, W., Matsumoto, K. 2022. Marine phytoplankton resilience may moderate oligotrophic ecosystem responses and biogeochemical feedbacks to climate change. *Limnology and Oceanography*, 67. DOI: doi.org/10.1002/lno.12029.
- Fawcett, S.E., Lomas, M.W., Ward, B.B., Sigman, D.M. 2014. The effect of summer-to-winter mixed layer deepening on eukaryotic new production in the Sargasso Sea. *Global Biogeochemical cycles*. DOI: 10.1002/2013GB004579.
- Martiny, A.C., Pham, C., Primeau, F., Vrugt, J., Levin, S., Lomas, M.W. 2013. Strong and reproducible latitudinal patterns in marine plankton elemental composition. *Nature Geoscience*, 6:279-283.
-